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Docket No. 55807 (70904)

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

APPLICANT: S. Okamoto et al.

U.S. SERIAL NO.: 09/835,194 GROUP: 2673

FILED: April 13, 2001 EXAMINER: L. Shapiro

FOR: IMAGE REPRODUCING METHOD, IMAGE DISPLAY APPARATUS AND PICTURE SIGNAL COMPENSATION DEVICE

CERTIFICATE OF EXPRESS MAILING

I hereby certify that this paper (along with any paper referred to as being attached or enclosed) is being deposited with the United States Postal Service on this date February 4, 2004 in an envelope as "Express Mail Post Office to Addressee," mailing Label Number EV438970694US addressed to the: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

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Commissioner for Patents
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Sir:

RESPONSE TO OFFICE ACTION

Applicants are in receipt of the Office Action dated November 20, 2003 of the above-referenced application. Please amend the application as follows:

Claims 1-9, 11-16, 18-28, 30-38, 40-48, and 50-61 are pending in the application. Applicants' remarks in the Amendment dated September 25, 2003 are incorporated by reference herein.

Claims 1-6, 9, 11, 12, 14, 15, 57-59 and 61 were rejected under 35 USC §103(a) as being unpatentable over U.S. Patent 5,546,134 to Lee in view of Japanese Publication 06-006820 to "Tadashi". Claims 16, 18, 20, 38, and 40 were rejected under 35 USC §103(a) as being unpatentable over U.S. Patent 6,278,436 to Hosoi et al. (hereinafter "Hosoi") in view of Tadashi.

Claims 8, 22-28, 30-33, 35-37, 42-48, 50-56, and 60 were rejected under 35 USC §103(a) as being unpatentable over Lee and Tadashi in view of U.S. Patent 6,289,162 to Uehara et al. The remaining dependent claims also were rejected on combinations of prior art references. These rejections are respectfully traversed.

As noted on page 2 of the Final Office Action, Lee fails to teach or suggest an image display apparatus or image reproducing method in which the image is reproduced so that **maximum output brightness** of a pixel varies in accordance with the average signal level.

Tadashi fails to remedy the deficiencies of the Lee reference. With reference to paragraph 0021, Tadashi teaches that a gamma compensation memory can be formed from any combination of a memory for white-level extension of an input signal, a memory for black-level extension of the input signal, and a memory for brightness level extension thereof. In other words, with respect to the total range of input brightness levels (e.g., 00-FF levels in the case of an 8-bit signal), gamma compensation memories corresponding to respective brightness level range extensions are provided so that signal conversion can be carried out.

With reference to FIGS. 2(b) and 3(b) of Tadashi, paragraphs 0018-0021 teach that for a signal APL of a predetermined average brightness level, a signal conversion as a brightness I(0 through $V_m/2$)=V^{r1} is carried out when an input signal brightness level V is in the range from 0 through $V_m/2$, and a signal conversion as a brightness I($V_m/2$ through V_m)=V^{r2} is carried out when the input signal brightness level V is in the range of $V_m/2$ through V_m.

In contrast, the Applicants' claimed invention requires that the image be reproduced so that maximum output brightness of a pixel varies in accordance with the average signal level. For example, as taught in the specification, an operation circuit calculates a gamma compensation value based on the average brightness level (see page 32, line 18 to page 33, line 5). Maximum output brightness, which is independent of the gamma compensation value, is then calculated based on the average brightness level (see page 34, lines 3-15). Concerning the gamma compensation, at an average brightness level G, a gamma compensation value with

respect to an input signal g is constant over the entire input range. For instance, a signal conversion for a brightness I(0 through $V_m/2$)=g^{r1} is carried out when the input signal brightness level g is in the range of 0 through $V_m/2$, while a signal conversion as a brightness I($V_m/2$ through V_m)=g^{r1} is carried out when the input signal brightness level g is in the range of $V_m/2$ through V_m. In other words, when the input signal is 8-bit, the gamma compensation value is constant over the entire range between 00-FF (in this case, the value is a compensation coefficient value $\gamma 1$).

Therefore, signal processing according to the Applicants' claimed invention is different from that taught in the Tadashi reference. Moreover, page 39, lines 10-18 of the specification teaches that a pattern of a gamma compensation value $\gamma(G)$ corresponding to the average brightness level G and a pattern of a maximum brightness level $i_{max}(G)$ corresponding to the average brightness level G are arranged in such a manner as to form a lookup table. <u>Tadashi does not teach or suggest a method of controlling a **maximum brightness level**</u>.

Regarding the Lee reference, Lee provides three examples of signal processing (FIG. 3). As shown in FIG. 3, a signal conversion characteristic yl is acquired when APL is in the range of 0 through m, a signal conversion characteristic y2 is acquired when APL is in the range of 1 through m, and a signal conversion characteristic y3 is acquired when APL is approximately 0.5. As to the input signal characteristics, column 3, lines 53-54 shows that $y1(x)=x^{0.5}$ and $y2(x)=x^2$. An input signal characteristic for y3 is represented by an equation which is divided by m=0.5 (median point of an input signal range), where an input characteristic is an inverse of an output characteristic, that is, $y3_L(x)=x^2$ and $y3_H(x)=x^{0.5}$. When the characteristics are simply represented as above, y3 is discontinuous at m=0.5. To smooth this, as taught in column 4, it would be necessary to add a gain to the y3 function. An example of this gain is a coefficient of $|(p-q)/p|$ (see expression (1) in Lee). According to expression (3) in Lee, a signal y3 is multiplied by a compensation coefficient and an amp coefficient based on nAPL. Column 5, line 55 and thereafter in Lee regards FIG. 7, where an amplifier 50 in FIG. 6 carries out a conversion process with characteristics S1-S3 shown in FIG. 7. According to FIG. 7, the upper limit of a gain characteristic in S2 is identical to S1, provided that where an input signal INPUT X is within the

range of m<x<L and an output signal OUTPUT Y is L=1, the gain is constant at 1 and the output signal OUTPUT Y does not exceed 1, when the input signal INPUT X is within the range of n<x<L. Because of the above, the amp coefficient determining gain is used in signal processing, and no conversion is carried out as in FIG. 7, from the point of view of a dynamic range of the output. In other words, in signal processing of an 8-bit signal, e.g., only a level of the 8-bit signal varies so that the range of the brightness output corresponding to the signal levels 00-FF is consistent.

In contrast, the Applicants' invention teaches that a maximum output brightness $i_{max}(G)$ is adjusted according to an average input signal level. Since the average input signal level of brightness G is provided as a continuous conversion from a standardized level 0 to level 1, there are no divisions corresponding to areas of the levels. Moreover, as shown in FIGS. 1-3 of the application, the maximum output brightness $i_{max}(G)$ is independent of the gamma compensation part, and thereby different from the picture signal conversion method disclosed in Lee. For example, when an 8-bit process signal is used in the process of FIG. 2, a display characteristic shown in FIG. 10 is provided. Assuming that the maximum output brightness level $i_{max}(G)$ is 100 when the average input signal level of brightness G is small, e.g., around 0%, this average input signal level of brightness G has an 8-bit gradation brightness. If the level G is instead around 100%, the maximum output brightness level $i_{max}(G)$ is around 40, but the average input signal level of brightness G also has an 8-bit gradation brightness.

As taught in FIGS. 4 and 5 (embodiment 3) of the application, a dynamic range of an output brightness provided by a compensation signal is constant, but the method of signal processing is different from that taught in Lee. According to FIG. 6 of Lee, a coefficient amp of a gain amplifier 50 is obtained from an APL calculator 20, and a look-up table block 30 calculates a conversion signal in accordance with the coefficient amp and the result from the APL calculator, and consequently the conversion signal is output.

In contrast, FIG. 4 of the application shows that, in accordance with a result obtained from an average signal level operation circuit 1, a $\gamma(G)$ compensation circuit 5 and an adjustment circuit of maximum output brightness 3 generate a compensation signal g1 and a maximum output level i1, respectively, and a signal conversion circuit 21 generates a compensation signal. Furthermore, a signal conversion by an inverse property compensation circuit 6 is carried out so that a process for compensating a characteristic of an emission display element is performed, and consequently the compensation signal is supplied to a display device.

The above-described process taught in the Applicants' invention is significantly different from FIG. 7 of Lee, an amp coefficient (corresponding to $i_{max}(G)$ of the Applicants' invention), when an average brightness level APL is not less than 0.5, is in theory constant at 1 when an input signal level is not less than a predetermined level. This essentially means that, <u>in Lee, no maximum brightness adjustment is performed</u>. In contrast, the Applicants' claimed invention provides that the maximum brightness level is adjusted in the total range of the average input signal level G, so that a higher quality display is achieved.

For at least the above reasons, the combination of Lee in view of Tadashi fails to teach or suggest the Applicants' claimed invention, in which <u>an image is reproduced such that the **maximum output brightness** of the image varies in accordance with an average signal level</u>.

None of the other references cited teach or suggest the above-mentioned features of the Applicants' claimed invention. Therefore, none of the references could be combined to produce the claimed method and apparatus as recited in claims 1, 16, 22, 38, 42, or 57.

It is believed that the claims are now in condition for allowance. However, if there are any outstanding issues, the Examiner is urged to call the Applicants' representative at the telephone number listed below.

Applicants believe that additional fees are not required for consideration of the within response. However, if for any reason a fee is required, a fee paid is inadequate or credit is owed for any excess fee paid, the Commissioner is hereby authorized and requested to charge Deposit Account No. **04-1105**.

Respectfully submitted,

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Date: February 4, 2004

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